Table VII
Tractor Operation by Season, Percent Overall

	Spring	Summer	Fall	Winter	
Plowing	35.6* / 55.3**	26.3 / 37.2	35.0 / 39.3	3.1 / 21.1	100.0%
Discing	21.3 / 6.9	11.3 / 3.3	59.5 / 13,8	7.4 / 10.4	100.0%
Cultivating	22.7 / 7.9	9.6 / 3.0	61.5 / 15.6	6.2 / 9.6	100.0%
Threshing	0 / 0	80.6 / 17.5	19.4 / 3.4	0 / 0	100.0%
Hauling	L6.L / 11.9	41.4 / 27.6	28.8 / 15.4	13.7 / 44.5	100.0%
Custom Work	49.9 / 10.8	9.5 / 1.9	34.9 / 5.5	5.7 / 5.4	100.0%
Scraping & Leveling	26.6 / 6.4	43.7 / 9.5	21.2 / 3.7	8.5 / 9.0	100.0%
Planting	14.3 / .8	0 / 0	35.7 / 3.3.	0 / 0	100.0%
	100.0%	100.0%	100.0%	100.0%	

*35.6 percent of all plowing was done in the springtime

**55.3 percent of all springtime tractor use was for plowing.

Table VIII
Types of Crops on Which Tractors Were Used.
Number of Jeribs and Percent
Of Usage by Area of Various Crops

	NORTH Av. No. Jeribs Per Tractor				CENTRAL Av. No. Jeribs Per Tractor			
	Own Land	Others Land	Total	Percent of total Tractor Use	Own Land	Others Land	Total	Percent Of Total Tractor Use
Irrigated Wheat	136.0	24.1	160.1	35.2	102.3	35.8	138.1	18.2
Dryland Wheat	77.4	0	77.4	17.0	230.7	308.7	539.0	70.9
Corn	15.4	0	15.4	3.4	0	0	0	0
Barley	22.0	0	22.0	4.8	1.7	0	1.7	.2
Mung Beans	5.7	0	5.7	1.3	0	0	0	0
Cotton	53.2	14.3	67.5	14.8	0	0	0	0
Clover & Alfalfa	1.1	0	1.1	.2	40.6	1.3	41.9	5.5
Oilseeds	15.4	0	15.4	3.4	11.7	0	11.7	1.5
Melons	5.9	0	5.9	1.3	7.0	0	7.0	.9
Other	18.6	65.8	84.4	18.6	21.3	0	21.3	2.8
Total	350.7	104.2	454.9	100.0	415.3	345.4	760.7	1000

Table VIII
(continued.)

SOUTH Average No. Jeribs Per Tractor Own Land	SOUTH Average No. Jeribs Per Tractor Others' Land	SOUTH Total	SOUTH Percent of Total Tractor Use	OVERALL Average No, Jeribs Per Tractor Own Land	OVERALL Average No, Jeribs Per Tractor Others' Land	OVERALL Total	OVERALL Percent of total Tractor Use
348.3	32.9	381.2	75.1	213,8	30.9	244.7	43.7
0	0	0	0	87.5	84.1	171.6	30.7
41.8	0	41.8	8.2	22.0		22.0	3.9
15.7	0	15.7	3.1	13.9	0	13.9	2.5
5.1	0	5.1	1.0	3.9	0	3.9	.7
20.1	14.3	34.4	6.8	25.2	10.4	35.6	6.4
7.1	0	7.1	1.4	14.3	.4	14.7	2.6
0	0	0	0	8.1	0	8.1	1.4
4.9	0	4.9	1.0	5.8	0	5.8	1.0
17.3	0	17.3	3.4	18.7	20.9	39.6	7.1
460.3	47.2	507.5	100.0	413.1	146.7	559.8	100.0

Table IX

AVERAGE NUMBER OF FIELDS AND AVERAGE SIZE IN JERIBS OF LARGEST AND SMALLEST FIELD ON WHICH TRACTORS WERE USED

	Number of Fields	Largest Field	Smallest Field	All Fields
North	7.	295	9.4	
Central	12	276	23.0	
South	--	136	8.8	46.8
Overall	--	224.8	12.9	

Table X shows which of these implements were owned, most used and least used, by area. For the overall study, the plow was most used and the scraper, or blade, was least used. Very few implements not included in the package deal had been obtained by tractor owners. In the south, farmers indicated which additional implements they would like to buy. Of 47 responses (several tractor owners indicated more than one implement) fifteen wanted grain drills, fourteen wanted threshers and eight wanted a a ridger-ditcher attachment. Other implements mentioned were: mower - 2, manure spreader - 2. cotton planter - 1, and feed grinder - 1. These responses, although not indicative of effective demand, do show which implements farmers feel the greatest need for in the south.

Ownership Costs:

Tractors were sold with implements as follows:

Byelarus -- 26[illegible],262,3[illegible] afs

Massey-Ferguson -- 363,353,97 afs.

Terms were five years to repay at 6% interest on unpaid balance. A 25% down-payment was required. Total cost of

tractors and implements, including interest, was 300,039.17 afs for the Byelarus tractor and 413,650.65 afs for the Massey-Ferguson tractor. Tractor taxes were reported by some owners to be as high as 15,000 afs per year.

Table XI shows what operators expected in terms of useful life and salvage value and, consequently, depreciation (calculated by the straight-line method). According to the experience of Indamer Workshop in Kabul and Mr. Arden Fabricius, the Agricultural Engineer at the Faculty of Agriculture at Kabul University, these estimates are overly optimistic. Actual depreciation per year should be about 27,000 afs per year for the Byelarus tractor and 42,000 afs per year for the Massey-Ferguson, assuming about ten years of useful life for the Byelarus and nine years for the Massey-Ferguson. These are raw estimates, based on information from <u>Costs of Owning and Operating Farm Machinery</u> by Greer, et al., University of Nebraska, U. S. A.

<u>Operating Costs</u>:

Operating costs for three regions are shown in Table XII . Per hour fuel costs for the Byelarus tractor are almost 60 percent higher than for the Massey-Ferguson and time required for various operations does not seem to differ greatly between the Massey-Ferguson and Byelarus tractors.

Due to differences in enumeration techniques, the authors believe that costs other than fuel and oil costs and wages were understated, especially in the north and central areas. The following total operating costs are felt to be more in line with reality.

North (Byelarus)	80,000 afs per year
Central (M-F)	100,000 afs per year
South (M-F)	95,000 afs per year

Table XI

TRACTOR DEPRECIATION SCHEDULES BY REGION
TRACTOR OWNERS" EXPECTATION OF USEFUL LIFE AND SALVAGE VALUE

	NORTH	CENTRAL	SOUTH
Make of Tractor	Byelarus	MF	MF
Original Cost plus Interest (5 years 6%)	311,829	435,247	435,247
Useful Life	19	32	12
Salvage Value	11,111	48,000	77,222
Depreciation/Year	15,827	12,101	29,835

The reader should bear in mind that total costs are for differing yearly usage -- 1138 hours per year in the north, 2191 in the central area and 1500 in the south.

Although the Massey-Ferguson tractors in the south were older than those in the central area, they were used more intensively and, therefore, probably required about the same amount of repairs. Repairs include tires and batteries although none of the owners had replaced rear tires.

Costs of fuel vary from 20 afs per imperial gallon (16.7 afs per U. S. gallon) to 4 afs per litre (15.14 afs per U. S. gallon). In addition, irregularities involving extra costs in obtaining fuel and parts were reported. For fuel, these could not have been very bad, however, because our computation of fuel consumption

Table X

TRACTOR IMPLEMENT UTILIZATION IMPLEMENTS OWNED MOST USED AND LEAST USED, BY REGION AND IN OVERALL STUDY

	NORTH				CENTRAL				SOUTH				OVERALL			
	Owned	Most Used	Least Used	Never Used	Owned	Most Used	Least Used	Never Used	Owned	Most Used	Least Used	Never Used	Owned	Most Used	Least Used	Never Used
Plow	14	10	--	--	12	3	1	--	13	17	0	--	44	30	1	--
Disc	14	1	2	--	12	1	7	4	13	10	6	--	44	12	15	4
Field Cultivator*	2	--	--	--	11	7	--	--	13	3	--	--	31	15	--	--
Trailer	14	4	--	--	12	1	--	--	13	2	4	--	44	5	3	--
Scraper	14	7	--	--	12	3	1	--	13	2	8	--	44	5	16	--
Seeder	1	--	--	1	1	--	1	--	--	--	--	--	2	--	1	1
Harvester	--	--	--		1	--	1	--	--	--	--	--	1	--	1	--
Pulley	1	--	--	1	2	--	--	1	--	--	--	--	3	--	--	2

*In the north and central, used for plowing.

shows about 1.14 U. S. gallons per hour consumption for Massey-Ferguson tractors. The Nebraska Tractor Test Data book for 1969 reports that this type of tractor should use 1.?4 U. S. gallons per hour with "average load".

Table XII

COSTS OF OPERATION --TRACTORS

	NORTH Afs/ Hour	Afs/ Year	Total	CENTRAL Afs/ Hour	Afs/ Year	Total	SOUTH Afs/ Hour	Afs/ Year	Total
Fuel*	27.0		32,076	17.2		37,685	17.0		25,500
Plowing	31.2			20.0			18.6		
Hauling	13.6			11.6			13,7		
Oil		4,889	4,889		6,102	6,102		4,104	4,104
Grease									
Transmission			508			569			3,645
Lubrication		508			569			2,640	
								1,005	
Filters									
Air Cleaner									7,210
Oil								1,788	
Diesel								2,289	
								3,133	
Wages			19,320**			18,996**			24,000**
Driver		12,852			13,500			18,864	
Cleaner		2,268			1,296			936	
Repairs			7,844			8,092			27,906
Total Operating Costs			64,637			71.444			92,365

*Total Fuel Costs are obtained as follows:

(([(afs hr plowing x 2) (afs hr hauling x 1)] + 3) (average hours per year)

**Total wages includes 4200 afs per year for food, clothing and housing for drivers and cleaners. Most operators did not employ cleaners.

Indamer Workshop in Kabul provided standard prices for oridinary maintenance items. From notes on interview schedules, we found that some central and southern tractor owners are obtaining some of these items cheaper from other sources, particularly Pakistan. This is not intended as a criticism of Workshop policy and prices because our study does not include this phase of tractors in Afghanistan, and actual costs reported by owners are not high, on the average.

It is felt that most categories of costs of operation, especially in the north and central areas, are under-reported. Rough calculations indicate that costs per hour including depreciation are the afghani equivalent of about $1.40 in the south. This compares with costs of over $2.50 in the U. S. A. for this type of tractor.

"Down-Time" or the amount of time a tractor is inoperable awaiting repairs, is somewhat high.

Wages for tractor drivers are an expense not normally encountered in the U. S. and other countries, as the farm family usually does this. Wages for driver and driver's helper (cleaner) amount to about 20,000 afs per year -- roughly one-fourth of total costs. However, from notes on the questionnaire, this seems to be money well spent under current conditions. In more than one instance, inexperienced drivers certainly do not get the highest and best use of their machines. Most tractor owners were able to employ experienced drivers with some difficulty, but these drivers commanded a fairly high wage -- usually 2,000 afs per month.

As mentioned previously, taxes are an unknown, but possibly very significant, cost factor.

Effects of Tractors:

An attempt was made to measure changes in land use, crop production, sales of agricultural products, and labor and animal power. Terms of reference for the change were "before tractor was purchased" (which was, generally speaking, three years prior to enumeration or 1344) and "1347" -- the crop year immediately preceeding enumeration. Respondents were also asked to indicate if these changes (when change took place) was or was not due to tractor ownership.

On Area Cultivated Annually:

Table XIII shows overall land use before tractor and in 1347. A brief interpretation of this table reveals that tractors were responsible for an increase in farm size, number of jeribs planted, and jeribs irrigated. Largest increases were in rented land and there was a decrease in owned jeribs of dryland. This indicates that some owned acreage was brought under water command as a result of tractor ownership.

Table XIII shows changes in land use by area and Table XIV is a distribution of jeribs planted and farm size.

On Crop Production and Yields:

Table XV shows percent changes in area planted, production, and yield of various crops. When change was attributed to tractor ownership, area and production of all crops increased. Yield also increased for all crops except mung beans and chick-peas, clover and alfalfa, and oilseeds.

Table III. Tractor Utilization, 13[illegible]
Average Days of Use Per year by Various Operations

	Plowing		Planting		Cultivating		Discing	
	N*	Days	N	Days	N	Days	N	Days
North	[illegible]	73.[illegible]	3/1[illegible]	7.5	0	0	[illegible]/14	25.3
Central	12/12	7[illegible]	0	0	0	0	[illegible]/12	1.[illegible]
South	[illegible]/13	54.0	0	0	17/13	37.[illegible]	[illegible]	13.6
Overall	[illegible]4/44	70.9	3/[illegible]	2.4	17/[illegible]	15.5	2[illegible]/44	1[illegible]

	Threshing		Hauling		Custom Work		Land Leveling	
	N	Days	N	Days	N	Days	N	Days
North	9/1[illegible]	16.5	14/14	52.3	7/14	13.0	2/1[illegible]	[illegible]
Central	[illegible]/12	7.3	12/12	27.7	6/12	15.7	9/12	3[illegible]
South	1[illegible]/13	[illegible].3	13/13	22.6	5/18	4.0	0	[illegible]
Overall	3[illegible]/44	10.0	[illegible]4/44	33.4	1[illegible]/44	1[illegible].0	11/44	13.3

*N Number of operators who reported any amount of tractor use for specified operation expressed as a fraction of all tractors in region or in overall study.

Wheat is by far the most important crop in Afghanistan and also the only crop for which fairly reliable production data is available for the entire country. Wheat production actually did increase for the entire country by about 30 percent from 1344 to 1347 and much of this increase was from dryland acreage. According to Table XV, wheat production increased 98 percent for irrigated and 1428 percent for dryland on farms which attributed change to tractor ownership. (See Price and Crop Outlook for Afghanistan - August 1968 and September 1967 - available at USAID/Agriculture Division) This increase was attributed to favorable weather and higher prices.

As will be discussed later, the overall production increases could be valued at about 133,000 afs, almost half of which was sold.

(On Sales of Farm Products:)

Table XIX shows average sales in seers per farm and percent for the overall study. The average value of increased sales per farm is about 55,000 afs. Sales of all agricultural commodities (on farms that attributed change to tractor ownership) increased except in the case of fruits. In addition to increases in sales, more farms reported any sales during 1347 than before tractor was purchased. Tables XX, XXI, and XXII show sales by area.

Table XIII

CHANGES IN LAND USE BEFORE AND AFTER TRACTOR PURCHASE
AVERAGE JERIBS PER FARM REPORTING

	OVERALL Change due to Tractor Ownership					
	YES			NO		
	Before	1347	%△	Before	1347	%△
Jeribs Irrigated						
Owned	315	606	+92	1007	1050	+4
Rented	0	15		315	291	-8
Jeribs Dryland						
Owned	770	354	-54	336	175	-48
Rented	32	653	+1941	0	0	--
Jeribs Planted						
Owned	354	547	-55	286	443	+59
Rented	32	558	+1644	0	50	
Jeribs Fallowed						
Owned	230	319	+39	1253	1270	+1
Rented	20	20	0	35	90	+157

Table XIII

(Continued)

SOUTH

	Change Due to Tractor Ownership?					
	YES			NO		
	Before	1347	%Δ	Before	1347	%Δ
Jeribs Irrigated						
Owned	0	0	--	1213	1213	0
Rented	0	20	∞	315	332	+5
Jeribs Dryland						
Owned	0	0	--	0	0	--
Rented	0	0	--	0	0	--
Jeribs Planted						
Owned	540	685	+27	243	243	0
Rented	0	0	--	0	0	--
Jeribs Fallowed						
Owned	564	564	0	1789	1789	0
Rented	20	20	0	35	95	+157

TABLE XIII
CHANGES IN LAND USE BEFORE AND AFTER TRACTOR PURCHASE
AVERAGE JERIBS PER FARM REPORTING

	NORTH						CENTRAL					
	Change Due to Tractor Ownership?						Change Due to Tractor Ownership?					
	Yes			No			Yes			No		
	Before	1347	%Δ	Before	1347	%Δ	Before	1347	%Δ	Before	1347	%Δ
Jeribs Irrigated												
Owned	190	250	+32	525	604	+15	404	360	+113	1111	1186	+7
Rented	0	10	∞	0	50	∞	0	0	---	0	0	--
Jeribs Dryland												
Owned	0	210		99	99	0	770	390	-49	653	235	-64
Rented	32	653	+1941	0	0	--	0	0	--	0	0	--
Jeribs Planted												
Owned	198	371	+87	450	480	+7	200	487	+143,5	281	512	82
Rented	32	553	+1644	0	50		0	0	---	0	0	--
Jeribs Fallowed												
Owned	81	173	+120	180	180	0	46	238	+417	45	346	+669
Rented	0	0	--	0	0	--	0	0	--	0	0	--

Note: One landowner in the wouth had 13,634 jeribs owned, irrigated.
No change after tractor purchase.

Table XIV

DISTRIBUTION OF TØTAL JERIBS PLANTED AND TOTAL JERIBS IN FARM BEFORE TRACTOR PURCHASE AND IN 1347

Total Jeribs Planted	NORTH		CENTRAL		SOUTH		OVERALL	
	Before	1347	Before	134Ø	Before	1347	Before	1347
0	1	--	--	--	--	--	1	--
1 - 99	1	--	5	2	1	--	7	2
100 - 199	6	2	1	1	5	2	12	5
200 - 299	2	4	2	2	4	4	8	10
300-- 399	1	1	--	1	4	3	5	5
400 - 499	2	--	3	1	2	2	7	3
500 - 699	1	5	1	3	--	4	2	12
700 - 999	--	--	--	2	--	1	--	3
1000 - 1499	--	2	--	--	1	1	1	3
1500 - 1999	--	--	--	--	--	--	--	--
2000 - 2999	--	--	--	--	--	--	--	--
3000 +	--	--	--	--	1	1	1	1
Total Jeribs In Farm								
0	--	--	--	--	--	--	--	--
1 - 99	--	--	3	1	--	--	3	1
100 - 199	4	1	1	--	--	--	5	1
200 - 299	3	3	2	2	3	3	8	8
300 - 399	--	1	--	1	2	2	2	4
400 - 499	2	1	--	--	2	2	4	3
500 - 699	3	4	2	2	6	6	11	12
700 - 999	--	--	--	--	2	2	2	2
1000 - 1499	2	4	1	2	2	2	5	8
1500 - 1999	--	--	1	2	--	--	1	2
2000 - 2999	--	--	2	1	--	--	2	1
3000 +	--	--	--	1	1	1	1	2

Table XV

FARM CROP PRODUCTION -- PERCENT CHANGES IN YIELD AND CROPPING PATTERNS BEFORE AND AFTER TRACTOR PURCHASE ON FARMS OF TRACTOR OWNERS IN AFGHANISTAN

OVERALL

	Change Due to Tractor Ownership			Change NOT Due to Tractor Ownership		
	Area	Production	Yield	Area	Production	Yield
Irrigated Wheat	+58.9	+93.1	+ 24.9	- 0.4	+ 1.2	+ 1.3
Dryland Wheat	+ 1233.6	+1423.7	+ 14.9	+650.0	-28.6	-39.7
Barley	+ 42.6	+ 119.8	+ 54.1	+40.7	+ 25.7	- 10.6
Corn	+240.5	+370.7	+38.3	+ 4.2	+ 16.4	+ 11.6
Cotton	+ 102.2	+209.4	+ 53.2	+13.0	- 37.3	-44.4
Mung Beans & Chick-Peas	+ 244.6	+103.5	+ 39.5	-95.6	- 74.1	+434.1
Clover & Alfalfa	+263.8	+ 38.3	-48.2	+3.2	+ 23.1	+ 19.5
Oilseeds	+ 225.3	+196.5	- 9.2	+ 200.0	+ 200.0	NC
Other	+172.5	+348.2	+ 348.2	-19.6	+ 16.5	+168.4

TABLE XVIII

C. FARM CROP PRODUCTION - PERCENT CHANGES IN YIELD AND CROPPING PATTERNS BEFORE AND AFTER TRACTOR PURCHASE ON FARMS OF TRACTOR OWNERS IN SOUTHERN AFGHANISTAN

SOUTH

	Change Due to Tractor Ownership			Change NOT Due to Tractor Ownership		
	Area	Production	Yield	Area	Production	Yield
Irrigated Wheat	+62.0	+28.0	+40.0	-3.6	-1.3	+5.0
Barley	-15.1	+27.5	+50.0	+155.0	+25.0	-51.0
Corn	+301.0	+364.0	+15.5	-4.6	-12.0	-7.9
Cotton	+111.1	+325.0	+100.0	-65.0	-41.0	+66.0
Clover & Alfalfa	--	--	--	-16.0		

TABLE XVI

A. FARM CROP PRODUCTION - PERCENT CHANGE IN YIELD AND CROPPING PATTERNS BEFORE AND AFTER TRACTOR PURCHASE ON FARMS OF TRACTOR OWNERS IN NORTHERN AFGHANISTAN

NORTH

	Change Due to Tractor Ownership			Change NOT Due to Tractor Ownership		
	Area	Production	Yield	Area	Production	Yield
Irrigated Wheat	+86.2	+145.9	+32.1	+71.4	+55.9	-9.0
Dryland Wheat	+1007.6	+1788.2	+71.0	--	--	--
Barley	+119.6	+261.6	+65.0	-21.4	+25.9	+60.2
Corn	+33.3	+526.3	+296.8	--	--	--
Cotton	--	--	--	+51.9	+36.7	+58.4
Mung Beans & Chick-peas	+32.4	+85.3	+40.0	--	--	--
Oil Seeds	+116.7	+186.4	+33.0	--	--	--

TABLE XVII

B. FARM CROP PRODUCTION - PERCENT CHANGES IN YIELD AND CROPPING PATTERNS BEFORE AND AFTER TRACTOR PURCHASE ON FARMS OF TRACTOR OWNERS IN CENTRAL AFGHANISTAN

CENTRAL

	Change Due to Tractor Ownership			Change NOT Due to Tractor Ownership		
	Area	Production	Yield	Area	Production	Yield
Irrigated Wheat	+18.0	-6.1	-20.6	0	+13.6	-13.5
Dryland Wheat	+1670.7	+381.8	-73.7	+429.4	+25.0	-76.1
Clover & Alfalfa	+353.0	+ 88.3	-58.6	+20.0	+23.1	+2.59
Oil Seeds	+508.7	+229.4	-45.2	--	--	---

On Farm Labor Force:

Table XXIII is a two page table showing labor and animal power requirements before tractor purchase and in 1357. There was a noticeable change in tenancy arrangements from "Ejaradar" (who usually provide bullocks as part of the tenancy agreement) to Deqan who do not provide bullocks and consequently recieve a smaller share of crops. Over-all, 101 Ejaradar tenants were displaced by tractors but there was an increase of 68 Deqan tenants for a net of 33 tenants (7.5%) replaced by tractors.

Evidence obtained during interviews shows that the percentage share of Deqan tenants declined, but that actual share was greater because of increased production. This observation is not measurable.

Farm labor requirements increased significantly for full-time laborers. Unfortunately, units do not correspond for the various areas and changes in part-time labor cannot be shown for the overall study. However, it is safe to say that requirements for part-time labor increased more than for full-time.

On Animal Power:

Table XXIII shows the total and average number of bullocks before and after tractor ownership by area. From this it was determined that bullocks replaced per tractor were 3.36 in the north, 2 in the central area, and 9.6 in the south. One exceptionally large operator in the south who reported that forty bullocks were replaced by his tractor was deleted from these calculations leaving an average of eight bullocks per tractor in the south.

Table XIX
Sales of Agricultural Commodities Before and After Tractor Purchase, Average Sales in Seers Per Farm, Number of Farms Reporting, Sales and Percent Change by Crop and Whether Or not Change Was Attributed to Tractor Ownership

	OVERALL			
	Due to Tractor		NOT Due to Tractor	
	No. Farms Reporting	Av. Sales Per Farm (44 Farms)	No. Farms Reporting	Av. Sales Per farm (44 Farms)
Wheat (dryland & Irrigated)				
Before Tractor	14	676	7	906
1347	20	1772	10	1023
% Change		+162		+ 13
Barley				
Before	1	4	1	14
1347	3	69	3	55
% Change		+---		+293
Corn				
Before	5	78	2	149
1347	11	298	6	169
% Change		+282		+13
Cotton				
Before	10	307	9	314
1347	10	588	8	141
% Change		+ 92		-55
Clover & Alfalfa				
Before	1	45	1	2
1347	3	82	2	91
% Change		+ 82		+--
Melon & Watermelon				
Before	3	52	3	155
1347	6	395	3	200
% Change		+660		+ 29
Oil Seeds				
Before	3	17	-	--
1347	3	28	-	--
% Change		+ 65		+--
Fruits				
Before	3	95	4	80
1347	3	58	5	178
% Change		-39		+123
Sugar Beets				
Before	-	--	1	2251
1347	-	--	1	579
% Change		--		-74
Mash & Nakhod (mung beans)				
Before	3	19	-	10
1347	4	42	1	.3
% Change		+121		
Others				
Before	3	140	3	39
1347	3	291	3	36
% Change		+108		-8

Table XX
Sales of Agricultural Commodities Before and After Tractor Purchase, Average Sales in Seers per Farm. Number of Farms Reporting Sales and Percent Change by Crop and Whether of Not Change Was Attributed to Tractor Ownership

NORTH

	Due to Tractor		Not Due to Tractor	
	No. Farms Reporting	Av. Sales Per Farm (1[illegible] Farms)	No. Farms Reporting	Av. Sales Per Farm (1[illegible] Farms)
Wheat (Dryland & Irrigated)				
Before Tractor	3	464	1	71
1347	5	979	5	455
% Change	+ [illegible]	+111	+5[illegible]	+541
Barley				
Before	-	--	1	43
1347	-	--	2	129
% Change		--		+200
Corn				
Before	0	0	0	0
1347	1	71	4	143
% Change				
Cotton				
Before	4	679	3	750
1347	4	1250	4	1[illegible]3
% Change		+84		-48
Clover & Alfalfa				
Before	-	--	-	--
1347	-	--	-	--
% Change		--		--
Melon & Watermelon				
Before	0	0	-	--
1347	1	586	-	--
% Change				--
Oil Seeds				
Before	1	43	-	--
1347	1	57	-	--
% Change		+33		--
Fruits				
Before	2	226	1	4
1347	2	93	2	202
% Change		-59		+--
Sugar Beet				
Before	-	--	1	7075
1347	-	---	1	1819
% Change		--		-74
Mash & Nakhod (mung beans)				
Before	1	36	-	--
1347	1	57	-	--
% Change		+58		+--
Others				
Before	1	429	1	107
1347	1	857	1	107
% Change		+100		0

Table XXI
Sales of Agricultural Commodities Before and After Tractor Purchase. Average Sales in Seers per Farm. Number of Farms Reporting Sales and Percent Change by Crop and Whether Or Not Change Was Attributed to Tractor Ownership

	CENTRAL			
	Due to Tractor		NOT due to Tractor	
	No. Farms Reporting	Av. Sales Per Farm (12 Farms)	No. Farms Reporting	Av. Sales Per Farm (12 Farms)
Wheat (Dryland and Irrigated)				
Before Tractor	1	8	3	717
1347	3	144	3	542
% Change		+--		-24
Barley				
Before	0	0	0	--
1347	1	44	0	--
% Change				--
Corn				
Before	-	--	-	--
1347	-	--	-	--
% Change		--		--
Clover and Alfalfa				
Before	-	--	-	--
1347	-	--	-	--
% Change		--		--
Cotton				
Before	1	167	1	8
1347	3	300	2	333
% Change		80		4066
Melon and Watermelon				
Before	1	33	2	417
1347	1	167	2	583
% Change		+406		+40
Oil Seeds				
Before	2	12.5	-	--
1347	2	37	-	--
% Change		+196	-	--
Fruits				
Before	-	--	-	--
1347	-	--	-	--
% Change		--		--
Sugar Beets				
Before	-	--	-	--
1347	-	--	-	--
% Change		--		---
Mash and Nakhod(mung beans)				
Before	1	12.5	-	--
1347	1	50	-	--
% Change		+300		--
Others				
Before	1	2	-	--
1347	1	5	-	--
% Change		+150	-	--

Table III shows the number of tractors used for the various operations and average number of days per year that the tractor was used for each operation. Number of tractors reporting for each operation is expressed as a fraction of all tractors in the area (or the overall study) - for example 14/18 tractors means that 14 of 18 tractors in the south were reportedly used for discing.

Many tractors were used indirectly in the planting operation even though this is not reflected in Table III. Many farmers pulled a mallah behind the disc or field cultivator to cover up seed which had been previously spread by hand.

Cultivating was reported as plowing in the northern and central areas because the implement there is known as a "chisel plow" and is generally used for stirring loose soil rather than cultivating growing crops. Use of the field cultivator or "chisel plow" is reported separately for the southern regions. (Field cultivator or tiller was not provided with Byelarus tractors.)

Most threshing was done by driving the tractor over grain on a traditional threshing floor.

Considerable tractor work in the central area was for land leveling, which indicates that considerable new land was brought into production or improved. Land leveling was negligible in the northern area and was not done in the south (most tractors in the south were on project land where leveling is done by the Helmand-Arghandab Valley Authority).

Table XXII
Sales of Agricultural Commodities Before and After Tractor Purchase. Average Sales in Seers Per Farm. Number of Farms Reporting Sales and Percent Change by Crop and Whether or Not Change Was Attributed to Tractor Ownership

SOUTH

	Due to Tractor		Not Due to Tractor	
	No. Farms Reporting	Av. Sales Per Farm (13 Farms)	No. Farms Reporting	Av. Sales Per Farm (13 Farms)
Wheat (Dryland and Irrigated)				
Before Tractor	10	1285	3	1682
1347	12	3473	4	1785
% Change		+ 70		+ 6
Barley				
Before	1	10	0	0
1347	2	139	1	35
% Change		+1290		∞
Corn				
Before	5	190	2	365
1347	10	674	2	302
% Change		+ 255		-17
Cotton				
Before	6	224	6	184
1347	6	464	4	40
% Change		+107		-78
Clover and Alfalfa				
Before	-	----	-	--
1347	-	----	-	--
% Change		----		--
Melon and Watermelon				
Before	2	106	1	100
1347	4	399	1	100
% Change		+276		0
Fruits				
Before	1	56	3	192
1347	1	70	3	278
% Change		+ 25		+45
Sugar Beet				
Before	-	----	-	--
1347	-	----	-	--
% Change		----		--
Mash and Nakhod (mung bean)				
Before	1	10	0	0
1347	2	24	1	1
% Change		+140		$+\infty$
Others				
Before	1	9	2	11
1347	1	42	2	5
% Change		367		-55

Table XX[illegible]

Labor and Animal Power Requirements Before and After Tractor Purchase
Totals, Averages, and Percent Changes for Tenants, Laborers and Bullocks

NORTH

	Tenants						Hired Labor						Animal Power		
	Ejaradar (Cashiqar)			Deqan (Buzgar)			Full-Time Laborers			Part-Time Laborers			Bullocks		
	N	Total	Average	N	Total	Average	N	Total	Average	N	Total	Average	N	Total	Avera
Change Due to Tractor Ownership															
Before	5	111	[illegible]	11	[illegible]	[illegible]	3	12	.75	0	0		5	100	7.1
1357	5	-60	4.3	11	36	6.1	3	22	1.6	1	30	2.14	1	46	3.3
Percent Change		-46			+43			+83						-54	
Change NOT Due to Tractor Ownership															
Before	1	30	2.1	--	--	--	6	13	.93	7	2766.	197.5	3	20	1.4
1357	1	120	1.4	--	--	--	6	12	.85	6	3850.	275	2	4	.2
Percent		-33			--			-3			+39			-80	

CENTRAL

	Ejaradar N	Total	Average	Deqan N	Total	Average	Full-Time N	Total	Average	Part-Time N	Total	Average	Bullocks N	Total	Avera
Change Due to Tractor Ownership															
Before	--	--	--	8	69	5.75	2	9	.75	4	1505	125.4	3	23	[illegible]
1357	--	--	--	7	80	5.7	2	15	1.25	4	1978	165	1	[illegible]	[illegible]
Percent Change		--			+16			+67			+31			-85	
Change NOT Due to Tractor Ownership															
Before	--	--	--	2	26	2.1	6	28	2.3	2	1400.	116.7	[illegible]	35	[illegible]
1357	--	--	--	2	26	2.1	6	18	1.5	2	1700	141.6.	[illegible]	44	[illegible]
Percent Change		--			0			-36			+21		[illegible]	-26	

Continued from Table XVIII

South

	Tenants						Hired Laborers						Animal Power		
	Jaradar (Cashgar)			Deqan (Buzgar)			Full-Time Laborers			Part-Time Laborers			Bullocks		
	N	Total	Average	N	Total	Average	N	Total	Average	N	Total	Average	N	Total	Aver
Change Due to Tractor Ownership											xxxx	xxx			
Before	[illegible]	70	3.9	12	119	6.6	10	51	2.8	8	--	--	15	260	14.4
1357	5	2[illegible]	1.1	14	150	8.3	12	50	2.8	8	--	--	3	83	4.6
Percent Change		-7[illegible]			+26			-2			+72			-66	
Change NOT Due to Tractor Ownership											xx				
Before	2	111	6.2	4	35	1.9	4	8	.4	8	--	--	3	18	1.0
1357	2	[illegible]	4.6	4	38	2.1	4	15	.8	8	--	--	1	6	.3
% Change		-25			+9			+87.5			+.7			-67	

Overall

	Jaradar N	Total	Average	Deqan N	Total	Average	Full-Time N	Total	Average	Part-Time N	Total	Average	Bullocks N	Total	Aver
Change Due to Tractor Ownership															
Before	[illegible]	181	4.1	31	248	5.6	15	72	1.6	12			23	388	8.8
1357	1[illegible]	30	1.8	32	316	7.2	17	87	2,0	13			8	133	3.0
% Change		-[illegible]			27			21						-66	
Change NOT Due to Tractor Ownership															
Before	3	1[illegible]1	3.2	6	61	1.4	16	49	1.1	17			14	103	2.3
1357	3	103	2.3	6	64	1.5	16	45	1.0	16			9	58	1.3
% Change		-27			5			-8						-44	

x N Number of farms reporting any tenants (or hired labor or bullocks)

xx Average per farm total divided by number of respondents (14 in North, 12 in Central, 13 in South, [illegible] in overall study.)

xxx Man-days of labor

According to respondants, the major problem of obtaining a tractor falls into the category of "problems in completing security arrangements." Generally, this refers to the red tape, waiting, and other time consuming and costly inconveniences at the local level. Over 80% of respondents who had problems, mentioned this general category.

The only other significant problem was that a 25% down payment was difficult to make, mentioned by 8 percent of the respondents with problems.

The major problem in owning and operating a tractor falls in the category of inadequate parts and repair service. Spare parts seemed to be an even bigger problem than repair services. Owners had to travel long distances to obtain parts and complained of high prices. Major workshops were in Kabul, Kunduz, Mazar-i-Sharif and Kandahar. Many parts were obtained in Pakistan.

Other problems mentioned were: 1) difficulty in obtaining fuel, 2) high taxes, and 3) accidents (one owner reported three accidents which killed three drivers).

Advantages of Tractors:

Major advantages of owning a tractor, in order, as perceived by owners, are as follows:

1. Increases in land productivity.
2. Saves on labor and animal power and does not reduce income of tenants.
3. Allows more land to be cultivated.
4. Allows reduction in number of oxen.

Major disadvantage of owning a tractor, a check question, turned out to be the same as problems of ownership - inadequate parts and repair services. High taxes on tractors were mentioned again.

In answer to "Where did your driver learn to drive?" it was ascertained that most drivers were trained on large development projects - Nangerhar or Helmand. Some learned at various workshops.

When asked "What do farmers in your area need most to improve their farming operation and farm income?" the majority said improved seed and chemical fertilizers. Other significant replies were - more tractors and more irrigation water. The need for agricultural extension assistance and more adequate workshops (for tractors) was also mentioned.

ECONOMICS OF TRACTORS

Costs and Benefits:

Table XXIV shows that average benefits from tractor ownership are about 47,000 afs per tractor per year. Tractors were most profitable in the north, quite economical in the south, but uneconomical in the central area due primarily to their high use in low return dryland wheat farming. Even if returns from custom work are considered, tractors were

a losing proposition in the central area.

Table XXIV

COSTS AND RETURNS FROM TRACTOR OWNERSHIP

	NORTH Afs/year	CENTRAL Afs/year	SOUTH Afs/year	OVERALL Afs/year
Cost:				
Operating Expenses	64,637	71,444	92,365	77,837
Depreciation	27,000	42,000	42,000	37,227
Total	91,637	113,444	134,365	115,064
Returns:				
Benefits from Extra Production	197,107	10,700	166,513	133,753
Saving on Oxen Maintenance	19.724	10.220	40,880	25,737
Depreciation	1,930	1,000	4,000	2,523
Total	218,761	21,920	211,393	162,063
Returns Less Cost	+127,124	-91,524	+77,028	+46,999

Table III shows average use for custom work to be 15.7 days per year. If tractors are paid for ten hours per day for 15.7 days of custom work per year, they will earn about 24,000 afs per year at the average rate of 153 afs per hour shown in Table IV.

When custom work earnings are considered, benefits from tractor ownership should be valued at 145,947 afs per year in the north, 35,028 in the south, and a loss of 67,503 in the central area.

The poor showing of tractors in the central area is partially explained by the fact that they are used a great deal on dryland wheat -- a rather uncertain and low yielding enterprise. See Table VIII which shows that on average over 70 percent of the land on which tractor was used was planted to dryland wheat (539 jeribs of dryland wheat out of a total

of 761 jeribs). Clover and alfalfa cultivation was also important in the central area, and this is not usually a good money crop in Afghanistan. Enumerator observation in the central area is that tractors are frequently used on widely separated fields. Table II shows that average monthly tractor use is excessively high (132.6 hours per month equals over 2,000 hours per year - 1200 hours per year is considered high in the U. S.).

For Table XXIV, the following prices were used to calculate benefits from changes in production.

Wheat	30 afs per seer	Melons	6 afs per seer
Barley	12 afs per seer	Oil Seeds	33 afs per seer
Corn	15 afs per seer	Fruits	20 afs per seer
Cotton	50 afs per seer	Mung Beans	40 afs per seer
Clover	3 afs per seer	Others	10 afs per seer

These prices are approximations made from prices during 1345 and 1346 obtained from the Kabul Weekly Retail Price Report (USAID/Agriculture Division) and adjusted for farm price, mostly on the basis of the author's experience. Information from <u>The Place of Cotton and Beet Sugar in the Economy of Afghanistan</u> by Allanson and <u>The Cotton Supply Response to Price Changes</u> by Keshawarz and Saunders (Ministry of Planning) was also used.

Costs of maintenance per oxen were 14 afs per day in all areas. This is based on information from a study of <u>Costs and Returns for Wheat Production</u> done by Dawlaty, Saleh and Owens. Oxen depreciation was taken from the same source.

SUMMARY AND CONCLUSIONS

Generally speaking, tractor ownership is practical on larger farms capable of intensive cultivation. Additional imports of tractors and implements, if properly placed and used, will be important to agricultural development in Afghanistan.

Tractor use, in terms of hours per month or hours per year, is high in Afghanistan, especially in the central area. Tractor use is spread fairly evenly throughout the spring, summer and fall months except in the south where most of the work is during the fall months. Tractors are used least in the winter, as would be expected.

Plowing is the most important tractor operation in terms of hours used, with hauling second. In view of the high number of hours tractors are used, there is some question as to whether hauling is the second best use for tractors.

In the over-all study, tractors are used on more jeribs of wheat than jeribs of all other crops -- almost 75 percent of the acreage on which tractors were used was wheat land. About 41 percent of this wheatland was dryland acreage, which usually gives poor returns. Almost 90 percent of all dryland acreage was in the central area.

The most used implements, according to operators, are the plow and field cultivator or tiller (the tiller was not part of the implement package for Byelarus tractors).

Least used implements are the blade and disc harrow. Farmers showed a great deal of interest in threshing machines, grain drills and ridger-ditcher attachments when asked what implements they would like to buy. A stationary threshing machine which could be powered by the tractor can probably be obtained at a reasonable price from Pakistan. Threshing machines would replace a great deal of labor, the wisdom of which has been questioned in Afghanistan. Although no measures of unemployment and underemployment exist, they are certainly problems. On the other hand, labor shortage at harvest time is also a serious problem in many areas.

Tractor owners are generally optimistic regarding useful life of tractors. Most of the tractors in this study will not be useful after ten years of life.

Costs of operating tractors, as reported in this study, are low compared to costs in the U. S. A. for comparable tractors. This is especially true for the north and central areas. This is probably partly due to under reporting of costs, partly to inadequate maintenance and partly to lower fuel and labor costs.

Major problems, according to tractor owners themselves, were encountered in: 1) completing security arrangements for the bank before taking delivery of tractor and 2) obtaining spare parts. The major advantages were: 1) increased land productivity and 2) savings of labor and animal power. Improved seed and fertilizer were seen as the greatest need for improvements in farming.

Significant increases in production and sales were attributed to the tractors in the north and south. Value of additional production was about 127,000 afs per year in the north and 77,000 afs per year in the south.

On the balance, very little if any human labor was replaced by tractors. There was a noticeable shift from "Ejaradar", who usually provide oxen as part of the tenancy agreement, to "Deqan" who are more on the order of full-time laborers. Tractors replaced an average of 3.8 bullocks per tractor in the north, 2 in the central area, and 8 in the south. This amounts to an average of 5.8 bullocks per tractor for the overall study.

Tractors were very economical in the north, economical in the south, and uneconomical in the central area where tractors were used heavily in low return dryland wheat production. Generally speaking the north is the most productive area with reference to water availability, climate and soils, and the central area is least productive. In addition, the tractors in the north have been in use longer. It is unlikely that tractors will ever be economical for dryland wheat farming in Afghanistan.

This study points out several things which should be considered seriously in determining agricultural future policy.

1. Some attempt should be made to provide better information to tractor owners and tractor drivers regarding proper and best use of their machines and implements. Apparently, many tractors do not receive proper maintenance.

Perhaps this could be done with information bulletins prepared in cooperation with the new workshop-school on the Ministry of Agriculture Daralaman Farm.

2. Assistance in improving parts availability and repair service is a strongly felt need on the part of the farmer. Means should be sought by which this can be done; perhaps through encouraging private enterprise.

3. Consideration should be given to a revised implement package -- certain items such as disc and scraper should be optional and other items should be available if the operator wishes to purchase them.

4. Tractor purchase by dryland wheat farmers should be discouraged and care should be taken to place tractors on land which can be more intensively cultivated.

5. An equitable policy for determining who receives tractors should be devised on the basis of type of farm, size of farm and location as well as operator's ability to pay. Red tape and other inconveniences should be reduced as much as possible, especially at the local administrative level. Current prices and interest rates seem reasonable, but ways of reducing costs to farmers are desireable.

WATER PUMPS

Twenty-seven water pump owners were interviewed who owned a total of forty-eight water pumps -- 1.78 pumps per farm. Some of the pump owners were reporting for their partners, so the concept of 1.78 pumps per farm is somewhat inexact. Thirteen sole proprietors reported owning a total of twenty-four pumps. The remaining twenty-four pumps were owned by 196 persons, some of whom owned as small as one-sixteenth share.

Most of the pumps were made in Pakistan; four were from the Soviet Union, two from Czechoslovakia and one from Japan. Twenty-four of the forty-one Pakistani pumps were of the Beco 20 HP type. Only nine of the forty-eight pumps were "portable"; the rest were stationary. Table XXV gives details of pump types. All pumps were powered by diesel motors.

Only the Beco 20 HP, Beco 7½ HP and Soviet 14 HP pumps were imported by the Bank. There were twenty-eight such pumps in this study; the other twenty pumps had been imported privately.

Eight of the forty-eight pumps were not operating for want of a well or repairs.

<u>Utilization</u>:

The Beco pumps were operated an average of 110 days per year and all pumps in the study averaged 93.4 days operation per year. Average hours of operation by season, for all pumps, ranged from 9.2 yours per day in the spring to

11.5 hours in the summer to 16.0 hours per day in the fall (See Table XXVL)/ Peak water use in Afghanistan is generally in the spring and summer. The reason for the more intensive pump use during the fall is that traditional water sources are prone to dry up as the seasons progress. None of the pumps were used during the winter.

Table XXVII shows that pumps were used primarily to irrigate wheat, which is usually irrigated before and after planting in the fall. Types of crops irrigated by water pumps correspond closely to types of crops on which tractors were used in the central area except in the case of dryland wheat, which is excluded from the pump study by definition.

None of the pump owners in this study sold water to other farmers or landowners (except their own tenents.)

Costs:

Pumps were sold on the same terms as tractors for the following prices.

Beco 20 HP	83,955 afs
Beco 7½ HP	54,541 afs
Soviet 14 HP	43,081 afs

Prives of pumps not imported by the Bank are not known.

As with tractors, pump owners tended to be overly optimistic regarding useful life and salvage value of pumps.

Calculations in this study were based on a salvage value of 10 percent at original cost and 10 years of useful life.

Table XXVIII shows costs for three horsepower categories of pumps and average yearly costs for all pumps. The figures show that operating costs were higher for 13-16 HP pumps than for 18-20 HP pumps. However, the depreciation is much lower when the price for the Soviet 14 HP pump is used.

Average operating expenses are about thirty afs per hour per pump for all pumps. By horsepower category, they are:

18-20	26.6
13-16	34,1
7½-10	25.3

According to these figures, the 18-20 pumps, particularly the Beco 20, are most economical. This is corroborated by the fact that half the pumps in the study are Beco 20's and most operators prefer Beco 20's or similar pumps if they intend or want to buy another pump.

Costs of well, including pipe and installation, were a very large item, averaging almost 50,000 afs per well. Most of the wells were dug by the owners with the help of hired labor (19 of 36 reporting). Twelve of thirty-six owners dug the wells themselves (probably cooperative projects among multiple ownership pumps) and 5 of 36 were dug exclusively by hired labor. Thirty-three of thirty-eight wells were hand dug to an average depth of 14.56 meters. The remaining fifteen were hand dug to an average depth of 14.3 meters and then extended

Table XXV - Number and Types of Water Pumps in Study

Brand Name	Country of Manufacture	Number of Pumps in Study by Horsepower Rating								Total Number in Study	Number	
		20	13	16	15	14	13	10	7.5		Portable	Fixed
Beco	Pakistan	24		1					3.	28	4	24
Atifaq	Pakistan			4						4		4
Badder	Pakistan		1		1	1				3		3
Matchless	Pakistan	3	1							4		4
Nessar	Pakistan					1				1		1
Hussain	Pakistan		1							1		1
?	Soviet Union				1		3			4	4	
?	Japan							1		1		1
?	Czechoslovakia			2						2	1	1
All Pumps		27	3	7	2	2	3	1	3	48	9	39

Table XXVI

WATER PUMP OPERATION -- DAYS OPERATED PER YEAR AND HOURS PER DAY BY SEASON, BY TYPE OF PUMP

		Days Per Year Of Operation		Average Hours Per Day Of Operation			
		Av.	Range	Spring	Summer	Fall	Winter*
Beco	Pakistan	110	20-235	10.5	10.6	14.3	0
Atifaq	Pakistan	135	90-180	18.2	23.0	18.2	0
Badder	Pakistan	115	105-120	18.6	8.0	17.3	0
Matchless	Pakistan	126	80-180	23.0	12.0	23.0	0
Nessar	Pakistan	80		23.0-		23.0	0
Hussain	Pakistan	135		22.0		22.0	0
	Soviet Union	75	30-120	2.0	12.0	11.3	0
	Japan	135		22.0		22.0	0
	Czechoslovakia	98	90-150	6.0	23.0	14.5	0
All Pumps		93.4		9.2	11.5	16.0	

* None of the pumps were operated during the winter.

TABLE XXVII -- JERIBS OF VARIOUS CROPS IRRIGATED BY WATER PUMP (1347).

Crop	N	Total Jeribs	Av. Jeribs/Farm	Av. Jeribs/Pump
Wheat	26	3.576	132.4	74.5
Alfalfa & Clover	13	472	17.5	9.8
Melons	6	77	2.9	1.6
Corn & Barley	7	109.5	4.1	2.3
Vegetables	3	9	.3	.2
Others	6	278	10.3	5.8

N Number of farms reporting

Average jeribs per farm = total jeribs ÷ 27

Average jeribs per pump = total jeribs ÷ 48

Table XXVIII -- Costs of Operation - Pumps

	18 - 20 HP			13 - 16 HP			7 - 10 HP		
	Afs Hour	Afs Month	Total Afs Year	Afs Hour	Afs Month	Total Afs Year	Afs Hour	Afs Month	Total afs Year
Fuel	12.7		16,764	13.2		16,027	10.7		13,053
Oil	2.63		3.469	4.26		5,170	4.0		4,350
Grease			366			206			113
Salary		786.7	9,440		1028.6	12,243		770.0	9.240
Repairs			2,171			4,703			1,250
Total Operating Costs			32,210			38,454			28,511

(Cont)

	All Pumps Afs Per Year
Fuel	
Oil	
Grease	
Salary	
Repairs	
Total Operating Costs	33,723

12.7 more meters (total depth 27 meters) by mechanical spudding or sinking iron tubing. Wells are usually round 3-4 meters in diameter with a rectangular or square shelf 3x4 to 4x5 meters, where the pump is placed about half-way down. A ramp is usually dug down to the pump beginning about 18-30 meters from the well site.

Tube wells of comparable depth would probably cost considerably less if drilled with modern machinery.

Effects of Pumps:

(On Area Planted Annually);

Apparently, water pump owners increased their acreage of all crops because of pump ownership. In most cases, production also increased, but yields decreased on all crops except vegetables. See Table XXIX. This indicates that the expected (or hoped for) amount of water was not forthcoming -- over-optimism again. Some operators did not get enough water because the well was inadequate and some pumps were inoperable for lack of repairs. Another factor causing low yield per jerib is the new non-previously-cultivated land brought under irrigation by water pump. Those lands are usually poor physically and low in organic matter. Twenty-four of the twenty-seven owners said irrigation water was inadequate for their land and fourteen of the twenty-four attributed this shortage to inadequate water from their well.

(On Crop Production And Yields;)

The 243.3 percent increase in wheat production alone represents a value (of increased production) of over 23,000 afs

per year per pump. Net value of increases and decreases in production, 28,806 afs per pump per year, is shown in the section on Economics of Pump Utilization. See Table XXXIII.

(On Sales of Farm Products;)

Sales of the following commodities increased, and most of the increases were attributed to tractor ownership:

Wheat	Melons
Corn	Alfalfa and Clover
Legume Crops	Oilseeds
Vegetables	Tobacco

There were no decreases in sales. Value of the increased sales which were attributed to pump ownership was about 7,800 afs per year per pump of 13,900 afs per year per farm, about 27 percent the value of increased production. This is shown in Table XXX.

Table XXXI shows that jeribs irrigated almost quadrupled after pump purchase, according to operators definition. Jeribs planted more than doubled. Jeribs of owned dryland declined by about 45 percent but jeribs fallowed increased greatly. Operators probably classify this as "irrigable" land for which there wasn't sufficient water. Virtually all changes in land use shown in Table XXXI were attributed to pump ownership.

(On Farm Labor Force;)

Table XXXII shows that all categories of tenants, laborers and bullocks increased when change was attributed to pump ownership. This change was most apparent in the Deqan tenant category. There were no ejaradar tenants.

Table XXIX

Farm Crop Production - Total Area Planted and Yield, Before Pump Purchase and in 1347

	DUE TO WATER PUMP					NOT DUE TO WATER PUMP				
	N	Jeribs	N	Seers	Yield	N	Jeribs	N	Seers	Yield
Wheat										
Before	14	784	14	16680	21.3	4	635	4	15900	25.0
1347	19	3988	19	57260	14.4	5	542	5	15705	29.0
% Change		+408.7		+243.3	-32.4		-14.6		-1.2	+16.0
Dryland Wheat										
Before	2	720	2	3500	4.9	7	892	7	3150	3.5
1347	2	8000	2	2140	2.7	5	1068	6	685	.6
% Change		+11.1		-38.9	-44.9		+19.7		-78.3	-82.9
Alfalfa & Clover										
Before	5	47	5	3210	68.3	4	225	4	2530	114.7
1347	8	467	8	9885	21.2	2	115	2	1600	139.1
% Change		+893.6		+207.9	-69.0		-48.9		-38.0	+23.3
Melons										
Before	1	2	1	1000	500.0	1	8	1	5000	600.0
1347	5	79	5	11600	146.8	1	5	1	2000	400.0
% Change		+3850.0		+106.0	-70.6		-37.5		-60.0	-36.0
Corn & Barley										
Before	1	9	1	580	64.4	1	10	1	800	80.0
1347	4	83.5	4	2580	30.9	2	37	2	1460	39.5
% Change		+827.8		+344.8	-52.0		+270		+82.5	+50.6
Vegetables										
Before	2	4.25	2	450	105.9	-	-			
1347	5	18.5	5	2340	126.5	1	.5	1	50	100
% change		+335.3		+420.0	+19.5					
Other Legumes										
Before	2	39	2	570	14.6					
1347	2	270	2	1900	7.0					
% Change		+592.3		+233.3	-52.1					
Others										
Before	1	1	1	40	40.0					
1347	1	4	1	160	40.0					
% Change		+300.0		+300.0	0					

Table XXX

Sales of Agricultural Products Before and After Pump Purchase Average Sales Per Farm. Number of Farms Reporting Sales. Percent Change and Whether or Not Change was Due to Pump Ownership

	Due To Pump		Not Due To Pump	
	No. Farms Reporting	Av. Sales/ Farm (seers)	No. Farms Reporting	Av.Sales/ Farm(seers)
Wheat Dryland & Irrigated				
Before	3	11.11	1	148
1347	8	300	2	166.7
Percent Change		+2600		+13
Barley				
Before	0	0	1	18.5
1347	0	0	1	3.7
Percent Change		0		-80
Cotton				
Before	0	0	0	0
1347	0	0	0	0
Percent Change		0		0
Corn				
Before	0	0	0	0
1347	4	+75.9	0	0
Percent Change				
Legume Crops				
Before	2	5.6	0	0
1347	2	26.0	0	0
Percent Change		+364		0
Vegetables				
Before	1	5.2	1	22.2
1347	2	51.2	1	22.2
Percent Change		+884		0
Melons				
Before	1	14.8	0	0
1347	2	148.1	0	0
Percent Change		+900.0		0
Alfalfa & Clover				
Before	0	0	0	0
1347	2	+75	0	0
Percent Change				
Fruit				
Before	0	0	1	17.3
1347	0	0	1	17.3
Percent Change		0		0
Oil Seeds				
Before	2	7	0	0
1347	2	27.8	0	0
Percent Change		+297.		0
Tobacco				
Before	1	.74	0	0
1347	1	2.2	0	0
Percent Change		+197		0

Table XXXI

Total Jeribs Irrigated, Total Jeribs Dryland, Total Jeribs Planted, and Total Jeribs Fallowed on Farms of 27 Water Pump Owners

	Before Pump		1347	
	N	Total	N	Total
Jeribs Irrigated				
Owned	20	5627	26	21921
Rented				
Jeribs Dryland				
Owned	14	7123	11	3799
Rented				
Jeribs Planted				
Owned	23	3471	27	9301
Rented				
Jeribs Fallowed				
Owned	13	961	16	3030
Rented				

N = Number of farms reporting

Table XXXII

Labor and Animal Power Requirements on Farms of Water Pump Owners

	Deqan[x]			Full-Time Laborers[x]			Part-Tm. Laborers[xx]			Bullocks[x]		
	N	Total	Average Per Farm	N	Total	Average Per Farm	N	Total	Average Per Farm	N	Total	Average Per Farm
Due to Pump Ownership												
Before	6	21	.8	1	3	.1	2	740	27.4	6	44	1.6
1347	12	142	5.3	3	17	.6	5	2435	90.2	8	78	2.9
Percent Change		+576.2			+466.7			+229.1			+77.3	
Not Due to Pump Ownership												
Before	8	44	1.6	5	19	.7	2	1040	38.5	14	88	3.3
1347	11	96	3.6	7	18	.7	8	2040	75.6	15	164	6.1
Percent Change		+118.2			- .05			+96.2			+86.4	

x Number of workers or animals per year

xx Man-Days per year

N Number of farms reporting

Average per farm = Total ÷ 27

Farmer's Attitudes, Opinions and Problems:

(Problems of Pump Ownership;)

Eleven of thirteen pump owners who reported problems in obtaining their pumps listed difficulty "in completing security arrangements" which may be defined the same as for tractor owners -- red tape, waiting, and "other costly and time consuming factors".

Major problems in operating the pumps were shortage of spare parts and inadequate repair service. Land dispute problems and disagreement among owners were mentioned and "well not deep enough".

(Advantages of Motor Pumps:)

The major advantage of owning a water pump was reported to be "adds new land to previous holdings" (20 of 27 replies). Seven operators reported that "it increases production". The major disadvantage was reported as difficulty in obtaining parts and repair service.

Pump owners were asked what farmers needed most to improve their farming operations and farm income. The significant replies, in order of importance, were:

1. Workshops and mechanics
2. More water for irrigation
3. Spare parts for farm equipment
4. Drilling machinery to increase water supply
5. Tractors

The also mentioned need for improved seeds, fertilizer, fuel stations, fruit trees and assistance in constructing wells.

Economics of Motor Pumps:
(Costs and Benefits;)

From the standpoint of our analysis, water pumps are not economical in the study area. Table XXXIII shows a net annual loss per farm of over 28,000 afs. While this analaysis does not take account of the costs of traditional water <u>saved</u> by pumps, neither does it take account of the extra costs occasioned by an increase in labor and animal power. These are unknown on unassignable quantities, but would tend to counterbalance each other.

There are, however, other considerations. The quantity of ground water for wells and pumps is not known -- how many wells and pumps will this water supply support and for how long. Regardless of costs and returns, this information must be obtained before decisions can be made regarding future pump use in this area.

Assuming the water supply is adequate for a given number of pumps for a reasonable period of time -- say forever -- a strong case for pumps may still be made for two reasons:

1. Reclaimed land will undoubtedly increase in value -- probably enough to offset the costs of pumps and initial decreases in yeilds.

2. The efficiency of farming on reclaimed land will probably improve with time. Much of the new land currently in use is only partially developed. When asked about plans

for improving their farm operations, 17 of the 27 respondents said they had definite plans to use improved seed (wheat seed) and were able to tell us how many seers they planned to use. Ten of these people also planned to use chemical fertilizer. Thirteen respondents were using or planned to use insecticides for specific purposes which they were able to state.

Table XXXIV is a distribution of farm size and jeribs planted. Unlike the situation for tractors, pumps are not necessarily most economical on larger acreage. Expert opinion is needed on amounts of water needed per jerib of various crops and how much water the various pumps can supply.

Summary and Conclusions:

The Beco 20 HP pump or its equilavent in other brands seems to be the most popular and most economical.

Peak pump use is in the fall and the water is used mostly for wheat. None of the pumps are used to supply water to persons other than the owners.

Costs of pump operation average over 33,700 afs per year of about 30 afs per hour. No basis of comparison was available to the authors. Costs of digging wells (which are probably not deep enough even at 100 feet) were found to be about 47,500 afs which is probably excessive.

As a result of pump ownership, area planted generally went up and production increased somewhat less, causing a decline in yields. Net value of changes in production amount-

ed to about 28,806 afs per pump per year, about one-fourth of which was sold. Most of the increases in production and sales were from wheat.

Jeribs irrigated almost quadripled, jeribs planted more than doubled, owned dryland acreage declined and jeribs fallowed increased.

All categories of tenents, laborers, and animal power increased, particularly tenants.

Farmers major problems were completing security arrangements and inadequate parts and repair service.

Major advantage was seen to be that the pumps add to landholdings and that pumps increase total production (but not productivity).

Farmer's most pressing needs seemed to be workshops and mechanics, additional irrigation water, and spare parts.

Pump irrigation was not economical in the study area but this may be mitigated by the facts that production will probably increase in a few years after the land is fully developed and that the value of reclaimed land will probably increase. At present farmers lack experience with pump irrigation and have tried to utilize more land than the pumps will supply water for. Farmers should be encouraged to use pump irrigation on high value crops. It has been repeatedly shown in other countries that pump irrigation is economically unfeasible on low value crops.

Table XXXIII

Costs and Returns from
Pump Ownership

	18-20 HP	13-16 HP	$7\frac{1}{2}$-10 HP	All Pumps
Costs				
Operating expenses	32,210	38,455	28.511	33,723
Depreciation:				
pumps - 10 yrs.	10,000	6,000	6,500	3,541
well, etc. 10 yrs.	5,430	5,233	1.423	4,749
20 yrs.	2,715	2,119	714	2,374
Total Cost - per pump				
Well life - 10 yrs.	47,640	49,693	36,439	47,013
Well life - 20 yrs.	44,925	46,574	35,809	44,638
Total cost - per farm				
Well life - 10 yrs.	84,704	88,354	64,361	83,539
Well life - 20 yrs.	79,877	82,809	63,519	79,366
Returns from extra				
Production - per pump				28,806
per farm				51.210
Returns less cost - afs/farm				
Well life - 10 yrs.				-32,379
Well life - 20 yrs.				-28,156

Table XXXIV

Land Use Distribution - Farms of Water Pump Owners

Total jeribs planted:

	Before	1347
0	4	
1 - 9	0	0
10 - 19	1	0
20 - 39	6	1
40 - 69	5	1
70 - 99	1	3
100 - 199	4	4
200 - 299	2	2
300 - 399	0	5
400 - 499	2	3
500 - 599	1	0
600 - 699	1	1
700 - 999	0	3
1000 - 1499	0	3
1500 +		T

Total jeribs in farm:

	Before	1347
0	0	0
1 - 9	0	0
10 - 19	0	0
20 - 39	4	0
40 - 69	2	1
70 - 99	1	2
100 - 199	2	1
200 - 299	2	1
300 - 399	2	4
400 - 499	4	4
500 - 599	3	3
600 - 699	1	2
700 - 999	0	1
1000 - 1499	1	4
1500 - 1999	1	2
2000 - 2499	1	0
2500 +	1	3

Before decisions regarding importation of pumps can be made, information about the ground water supply must be obtained.

Farmers need assistance (public of private?) in drilling wells (if the water supply is adequate for more wells.)

Care must be taken in selling pumps not to oppose land reclamation and resettlement policies. The value of multiple ownership should be studied more carefully.

Although not shown clearly by this study, pumps used for supplemental irrigation from sources other than wells are quite possibly economical, especially if they can supply water on a more timely basis.

Parts and repair service is a critical need, as for tractors.

Competent agricultural and engineering advice should be sought regarding pump performance and irrigation water needs of various crops.

Less custom work was done in the south than in the other areas. Some operators said they would do more custom work if parts were more readily available. See Table III for details of tractor utilization by operation. Table IV shows rates charged for custom work and Table V shows average time required for various tractor operations.

Tractors are most used in the fall. Next most important season is summer, then spring. Tractors are used very little in the winter. See Table VI.

Table IV. Rates for Custom Work.
Afs Per Hour for Plowing, Cultivating, Discing, By Region

	Plowing	Cultivating	Discing
North	150	140	140
Central	153	153	153
South	206	205	200
Overall	175	170	163

Table V
Time Required For Various Tractor Operations (Hours) Per Jerib

	NORTH		CENTRAL		SOUTH		OVERALL	
	Aver. Hours	Range	Aver. Hours	Range	Aver. Hours	Rng.	Aver. Hrs.	Range
1st Plowing	.67	.33-1	.63	.25-1	1.04	.[illegible]-1.50	[illegible]	
2nd Plowing	.61	.25-1	.33	.10-.75	.76	.50-1.00	.60	
Discing	.35	.12-.75	.21	.10-.33	.36	.20-.75	.32	
Cultivating					.36	.25-.50	.36	
Cultivating - Mallah Combination					[illegible]	.17-.67	[illegible]	
Disc-Mallah Combination					.25		.25	
Planting					.17		.17	

Table VI. Tractor Utilization, 1987
Average Days of Use, By Season

	Spring		Summer		Fall		Winter	
	N*	Days	N	Days	N	Days	N	Days
North	14/1[illegible]	57.3	13/14	59.2	14/14	57.[illegible]	8/1[illegible]	1[illegible].2
Central	12/12	59.7	11/12	54.9	12/12	48.3	8/12	6.5
South	13/13	27.3	13/13	40.6	18/18	75.9	11/13	6.7
Overall	[illegible]	45.63	42/44	50.[illegible]	[illegible]/44	62.4	27/44	10.2

*N Number of operators who reported any amount of tractor use during specified season expressed as a fraction of all tractors in region or in overall study.

Table VII shows percent of total seasonal use for various operations and percent of total use for various operations during each season.

Table VIII shows tractor use for various crops by area and in the overall study. From the standpoint of number of jeribs on which tractor was used, wheat is by far the most important crop. Cotton, corn, alfalfa and clover are also quite significant. Dryland wheat is quite important in the central area, but not in the south.

Table IX shows average size of largest and smallest fields on which tractor is used. From this information, it would seem that small field size is not a major problem for tractor utilization in Afghanistan. It should be noted, however, that after these fields are prepared and planted by the tractor, they are usually ridged and/or ditched into very small plots for flood irrigations. This would affect tractor cultivating and harvesting operations. Also, the ridges and ditches must be smoothed out before the tractor can be used to prepare the soil for the next crop. Many tractors in the central area are used on widely separated fields.

Implements provided as part of a "package deal" (inwhich the farmer had no choice) were, for the Byelarus tractor;

1. Three-furrowed moldboard plow
2. Disc Harrow
3. Four Wheel tractor-trailer
4. Front-mounted scraper blade

For the Massey-Ferguson 135:

1. Three furrow moldboard plow - MF 793
2. Tandrem Disc Harrow - MF 722
3. Nino-tine tiller (field cultivator or "chisel plow" MF 729
4. Three-ton tipping trailer MF 17-7
5. Multipurpose blade-terracer MF 721

XXV	NUMBER AND TYPES OF WATER PUMPS IN STUDY
XXVI	WATER PUMP OPERATION -- DAYS OPERATED PER YEAR AND HOURS PER DAY BY SEASON, BY TYPE OF PUMP
XXVII	JERIBS OF VARIOUS CROPS IRRIGATED BY WATER PUMP (1347)
XXVIII	COSTS OF OPERATION -- PUMPS
XXIX	FARM CROP PRODUCTION -- TOTAL AREA PLANTED, PRODUCTION, AND YIELD, BEFORE PUMP PURCHASE AND IN 1347
XXX	SALES OF AGRICULTURAL PRODUCTS BEFORE AND AFTER PUMP PURCHASE -- AVERAGE SALES PER FARM, NUMBER OF FARMS REPORTING SALES, PERCENT CHANGE AND WHETHER OR NOT CHANGE WAS DUE TO PUMP OWNERSHIP
XXXI	TOTAL JERIBS IRRIGATED, TOTAL JERIBS DRYLAND, TOTAL JERIBS PLANTED, AND TOTAL JERIBS FALLOWED ON FARMS OF 27 WATER PUMP OWNERS
XXXII	LABOR AND ANIMAL POWER REQUIREMENTS ON FARMS OF WATER PUMP OWNERS
XXXIII	COSTS AND RETURNS FROM PUMP OWNERSHIP
XXXIV	LAND USE DISTRIBUTION -- FARMS OF WATER PUMP OWNERS

SUMMARY OF KEY FINDINGS

Tractors

Average tractor use is relatively high in Afghanistan, as compared to U. S. A. standards, especially in the central area. Plowing is the most important use for tractors. They are also used a great deal for hauling and private transportation and are sometimes used in lieu of oxen in grain threshing operations.

Returns from tractor use on dryland crops were low.

Depreciation, operating costs and maintenance are higher than normal for the U. S. A. Operators expectations as to useful life seem to be overly optimistic.

In the early stages of partial mechanization covered by this study, tractor usage resulted in large increases in area cultivated, in total production and in sales of agricultural products. Tractors did not replace labor significantly, but caused a significant shift in tenancy and hired labor patterns. Deqan tenants (who furnished little more than labor in the tenancy arrangements) gained at the expense of ejaradar tenants (who furnish oxen, seed, etc. as well as labor). Also, hired labor gained slightly over tenants. Tractors replaced animal power very significantly.

Benefits from tractor use (value of additional production plus savings on oxen and income from custom work less total tractor costs) were about 6[illegible],04[illegible] afs per year for all tractors. Benefits were highest in northern Afghanistan (1[illegible]5,97[illegible] per year)

lower in southern Afghanistan (35,02%) and negative in central Afghanistan (-67,52%) where tractors were used a great deal on extensive farms (dryland wheat).

Pumps

Pumps in central Afghanistan are used about three months of the year for supplemental irrigation. Some have been used on newly reclaimed land and are the primary source of irrigation water. Pumps are used primarily to irrigate wheat and alfalfa and clover are the next most important crops.

Pump owners were able to increase their cropland more than 200 percent but there was evidence that they overextended themselves because yields declined.

Net percentage increases in sales were extremely high, but this is misleading because many pump owners began to sell farm produce only after they obtained the pumps.

Pump use resulted in significant increases in farm labor and tenants. Animal power requirements also increased, but slightly less than labor requirements.

Benefits to pump ownership based on net increases in production less additional costs were negative, on the average.

The following data are a summery of major findings:

TRACTORS

Utilization	Overall Average
Hours used per month	132
Percent of use for plowing	2
Percent of use for hauling	20
Percent of use on Irrigated Wheat	[illegible]
Percent of use on Dryland Wheat	31

Costs	Overall Average
Original cost of Byelarus tractors (afs)	311,320
Original cost of Massey-Ferguson tractors (afs)	35,247
Estimated useful life (years)	9-10
Annual depreciation - Byelarus (afs)	27,000
Annual depreciation - Massey-Ferguson (afs)	2,000
Annual operating costs - Byelarus (afs)	10,000
Annual operating costs - Massey-Ferguson (afs)	100,000
Rates for custom work (afs per hour)	170

Effects of Tractors on Production	Overall Average
Percent change in area cultivated annually	186
Percent change in annual output of major crops:	
Irrigated Wheat	+ 93
Dryland Wheat	+1423
Barley	+ 120
Corn	+ 371
Cotton	+ 209
Oilseeds	+ 343

Effects of Tractors on Sales	
Percent change in Crop Sales:	
Wheat (irrigated and dryland)	+162
Corn	+282
Cotton	+ 92
Clover and alfalfa	+ 32
Oilseeds	+ 65
Melon and watermelon	+660
Mung Beans	+121

Effects of Tractors on Farm Labor Force	
Percent change in number of:	
Total farm workers	-3.6
Ejaradar (keshtegar) tenants[1]	-56
Deqan (buzgar) tenants[2]	+27.
Full-time hired laborers	+21.

Effects on Annual Power Requirements	
Percent change in number of bullocks	-36

Benefits	
Value of additional output per farm per year (afs)	+133,753
Savings on oxen maintenance and degree per farm/year (afs)	+28,310
Total benefit per farm per year (afs)	+162,063
Less total tractor costs per farm per year (afs)	+115,064
Net benefit per farm per year (afs)	46,999

1) Keshtegar (Pashto) - a tennant who provides his own labor and other inputs such as oxen, implements, fertilizer in the tenure arrangement.

2) bazgar (Pashto)- a tennant who provides his own labor and little or nothing else in the tenure arrangement.

WATER PUMPS

Utilization

	Overall Average
Days operated annually	93
Percent use on:	
Wheat	79
Alfalfa and Clover	10
Corn and Barley	3
Melons	2
Other crops (including vegetables)	6

Costs

Original cost of:	
Beco (Pakistan) 20 HP (afs)	33,955
Beco (Pakistan) 7½ HP (afs)	54,511
Soviet 14 HP (afs)	43,031
Annual operating costs:	
18-20 HP	32,210
13-16 HP	33,[illegible]54
7-10 HP	23,511

Effects of Pumps on Production

Percent change in area cultivated annually	+256
Percent change in annual output of major crops:	
Irrigated Wheat	+2[illegible]3
Dryland Wheat	-39
Alfalfa and Clover	+203
Melons	+1060
Corn and Barley	+345
Vegetables	+420
Other Legumes	+233
Other Crops	+300

Effects of Pumps on Sales

Percent change in annual crop sales:	
Wheat (irrigated and dryland)	2600
Corn	
Vegetables	+334
Melons	+900
Oilseeds	+297
Tobacco	+107
Alfalfa and Clover	
Other Legume Crops	+364

WATER PUMPS

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Other Legume Crops	+364

FARM TRACTORS AND WATER PUMPS IN AFGHANISTAN - A STUDY OF UTILIZATION, ECONOMIC EFFICIENCY, TECHNICAL ASPECTS AND PROBLEMS OF AC UISITION AND OWNERSHIP

by

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Effects of Pumps on Farm Labor Force

	Overall Average
Percent change in number of:	
Total farm workers	+240
Deqan tenants	+576
Full-time hired laborers	+166
Part-time hired laborers	+229

Effect on Annual Power Requirememts

Percent change in number of bullocks	+77

Benefits

Value of additional output per farm per year (afs)	51,210
Less total pump costs per farm per year (afs)	83,589
Net loss per farm per year	-32,379

Farm Tractors and Water Pumps in Afghanistan - A Study of Utilization Economic Efficiency, Technical Aspects and Problems of Acquisition and Ownership

by K. Dawlaty, R. Saunders and G. Owens*

INTRODUCTION

Backround and Situation

Beginning about 1963, the Agriculture and Cottage Industries Bank of Afghanistan, hereafter referred to as the Bank, imported Byelarus and Massey-Ferguson tractors and four types of water pumps. These tractors and pumps were sold on credit to farmers in various parts of Afghanistan. Most of the Byelarus tractors were sold in northern Afghanistan; most of the Massey-Ferguson tractors were sold in central and southern areas. Water pump sales were concentrated in the Ghazni, Katawaz, Moqor and Kalat area of central Afghanistan. Table I shows the distribution of Bank-financed tractors and pumps by province.

Although a large number of water pumps have been imported privately, most of the privately owned farm tractors in this country have been imported under the auspices of the Bank.

Recently, the Bank ceased operations in this field, but is currently negociating a loan from the World Bank (IBRD) which will allow it to resume operations. This study was undertaken in hopes of improving future Bank operations in the field of financing agricultural equipment.

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Table I

The Distribution of Bank-Financed Tractors and Water Pumps in Afghanistan

Location	Tractors		Water Pumps		
Province	Beleyrus	Massey-Ferguson	20 HP	16 HP	7½ HP
Kabul	2	2	7	7	14
Logar	-	1	1	-	-
Paktia	-	4	3	-	-
Ghazni	2	24	69	7	6
Orozgan	-	-	-	-	1
Zabul	-	2	37	-	6
Kandahar	-	48	45	1	1
Helmand	-	35	-	-	1
Chakhansur	-	7	10		6
Farah	-	7	-	1	16
Ghor	-	21	-	-	-
Herat	-	-	6	-	2
Faryab	7	-	-	-	-
Jowsjan	3	-	-	1	-
Wardak	-	-	-	-	1
Balkh	32	-	1	-	1
Samangan	13	-	-	-	-
Kunduz	22	1	3	-	3
Baghlan	11	-	1	-	-
Parwan	-	-	-	2	3
Takhar	10	-	1	-	-
Kapisa	1	-	-	-	-
Laghman	1	-	-	-	-
Nangarhar	-	-	1	-	-
	15[illegible]	152	135	19	61
Ministry of Agr.	22	20	-	-	-
Nangarhar Project	10	-	-	-	-
Sugar Factory	2	-	-	-	-
Cash Sales & Oth.	12	23	-	-	-
	200	200	185	19	61

Some bad debts were accrued in previous operations. Also, conditions of future need and demand for tractors and pumps are unclear. This is also true for efficiency and economic performance of tractors and pumps in Afghanistan. More information on the relationship between mechanization and unemployment is needed. Information regarding the effect of tractors and pumps on land reclamation and development is also needed.

Objectives

The broad objective of this study is to shed as much light on the above stated problems as possible. More specifically:

A. To investigate conditions of need and demand for tractors and pumps by geographical area if possible.

B. To examine the current uses of tractors and pumps.

C. To examine the effects of tractor and pump ownership on employment and land use.

D. To investigate problems associated with obtaining tractors and pumps and problems associated with ownership and operation.

Procedures

The primary tool for gathering information for this study was personal interviews with tractor and pump owners using a schedule pretested with tractor and pump owners near Kabul. Related data and information from other sources were used whenever possible. Twenty-eight tractor owners were personally interviewed by author Dawlaty in the northern and central areas. Professor Dawlaty also personally interviewed 27 pump

owners who had a total of 43 pumps in the central area. These interviews were conducted in April and May, 1969. Mr. Lewis Clark, Agricultural Credit Specialist, USAID Lashkar Gah, and associates interviewed 13 tractor owners in the southern area during this same period.

A list of all tractor and pump owners provided by the Bank was stratified geographically and randomly sampled. An alternate sample was drawn for use when owners selected in the stratified random sample were not available for interview.

After enumeration, data were tabulated in raw form and then analyzed by various sorts and cross-tabulations to obtain the required descriptive data and relationships.

Limitations of Study

The major limitation to this study results from size and stratification of sample. Although the universe was not large (00 tractors and 265 water pumps) only 44 tractors and 43 pumps were covered by survey information. This was due to the decision to make extensive interviews and to limitations of time and funds. Only three major areas (7 provinces) were studied, leaving out tractor use in western Afghanistan

The study was designed, tabulated, analyzed and reported in English while enumeration was carried out in Farsi.

Definition of Terms

Ejaradar - Persian word for tenant classification; usually provides seed, machinery and animal power as part of tenancy share arrangement.

Cashgar - Pashtu word equivalent of efaradar.

Deqan - Persian word for tenant classification; provides less than ejaradar tenants and recieves a smaller share of crops.

Buzgar - Pashtu equivalent of deqan.

1 jerib = .4734 acres = .1936 hectares

1 seer = 15.53 pounds = 7.066 kilograms

1347 (local year) = March 21, 1968 to March 20, 1969

100 afs = $1.33 U.S. (75 afs = $1,00 U. S.)

TRACTORS

Utilization

Tractors in this study range from six years of age to less than one year. Most of the tractors were purchased in 1345 and 1346 (roughly 1966 and 1967).

Tractors in the notth had been used an average of about 17 months, those in the central area about 11 months and those in the south about 20 months. Average total hours used ranged from 1849 in the central area to 2434 in the south. Average hours per month were about 99 in the north, 133 in the central area and 124 in southern Afghanistan. This is relatively high usage compared to U. S. standards. Daily use during the busy season averaged 9.36 hours in the central area, 10,57 hours in the north and 12.2 in the south. Number of idle days per year ranged from 119 in the south to 134 in the central area, This information is shown in detail in Table 11.

Plowing was by far the most important use for tractors, as all 34 were used for this purpose. All tractors were used for hauling also, but they were not used as much for this purpose.

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Table II. Tractor Utilization. 19[illegible]7

Months Used, Hours Used, and Average Hours Per Month, Hours Per Day During Busy Season and Days Idle Per Year, By Region

	Months Used		Total Hours Used		Hours Per Month		Hours per Day Busy Season		Days Idle Per Year	
	Aver.	Range	Aver.	Range	Aver.	Range	Aver.	Range	Aver.	Range
North	19.0	9-31	1881	1500-3260	99.0	65.6-166.7	10.6	9-12	135.[illegible]	71-18[illegible]
Central	10.1	6-13	1848	1026-2025	182.6	78.9-202.5	9.4	8-12	1[illegible]	105-2[illegible]5
South	19.7	14-27	2434	1000-5500	123.9	58.0-220.0	12.2	8-13	1[illegible].6	60-1[illegible]
Overall	16.6	6-36	2098	1000-5500	132.0	58.0-202.5	10.9	8-13	141.[illegible]	60-2[illegible]

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